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Comparison of the process of care of acute severe asthma in adults admitted to hospital before and 1 yr after the publication of national guidelines

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This study set out to assess the effect of publication of the British Guidelines on Asthma Management on the processes and outcomes of the inpatient care of acute severe asthma in the U.K. A criterion-based audit of all acute asthma admissions during August and September 1990 (immediately before) and in 1991 (1 yr after publication of the Guidelines) using eight criteria of process and outcome was performed. Thirty-six teaching and district general hospitals in England, Scotland and Wales took part. In total, 766 patients admitted in 1990, and 900 patients admitted in 1991, were studied.

The 1990 and 1991 cohorts were very similar demographically and had asthma of comparable severity. Respiratory physicians achieved similar high performance rates of between 75 and 91% for seven of the eight criteria for both years. Respiratory physicians were significantly more likely to provide patients with a written management plan in 1991. General physicians' performance was significantly lower in both years, but overall there was a very small, but just significant, improvement in their performance in 1991. Some hospitals performed consistently well in both years. It is concluded that respiratory physicians consistently provide better asthma care than general physicians. Though statistically significant, the small degree of improvement was disappointing. Possible reasons include: insufficient time for the Guidelines to be incorporated into practice; inaccessibility of the Guidelines to general physicians; failure to accept responsibility for implementing the good practice reflected in the Guidelines; and an explicit need for strategies to implement the Guidelines beyond publication in a widely-read general medical journal.

Introduction

Asthma is the most common chronic disease affecting all age groups in Britain, with a prevalence of up to 13% in children (1) and of up to 8% in young adults (2). Asthma deaths increased throughout the 1980s and asthma was the only one of nine avoidable causes of death where the standardized mortality ratio was higher in 1987 than in 1979 (3). Studies of asthma deaths reviewed recently (4) have shown that there are potentially preventable factors in over 80% of cases. The most common problems identified have been a failure by the patient and/or the doctor to appreciate the severity of the fatal attack, usually because of a failure to make objective measurements of severity, coupled with a failure to prescribe systemic steroids. For these reasons, the British Thoracic Society initiated the development of guidelines on the management of asthma. The first Guidelines were published in 1990 (5) and the revised Guidelines were published in 1993 (6).

An audit of the hospital management of acute severe asthma in adults was performed in August and September 1990, immediately before the publication of the Guidelines. The main conclusions (7) were that the asthma care provided by respiratory physicians was significantly better than that provided by non-respiratory physicians, and that there was room for improvement in asthma care in many hospitals. The present paper reports the results of a repeat multicentre audit performed 1 yr after publication of the first set of Guidelines, and compares the results with the pre-publication audit in an attempt to measure the effect of the formulation and publication of the National Guidelines.

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Table 1 Eight variables reflecting the process of care during an admission with acute severe asthma

Peak flow should be measured on arrival at hospital.	An indicator of asthma severity and that airflow obstruction was being assessed objectively.
PCO_2 (i.e. arterial blood gases) should be measured in all asthmatics admitted to hospital.	Ideally, PO_2 would be recorded but the concomitant administration of oxygen makes interpretation of the actual values impossible. However, PCO_2 implies that oxygen status was being considered and a raised PCO_2 is a marker of severity.
Systemic steroids should always be given (question assessed use during first 24 h).	Asthma is characterized by inflammation and thus the use of systemic steroids is a marker that the asthma is being treated seriously. Non-use is difficult to justify.
Peak flow variability should be measured to assess asthma control before discharge.	Objective measurement of PEF on the ward allows for more accurate assessment of a patient's response, and high PEF variability links to poor control and earlier re-admission.
Inhaled steroids should be prescribed to take home.	This is a marker that the doctor is looking ahead to controlling the ongoing morbidity and preventing future admissions from asthma.
Oral steroids should be continued after discharge i.e. prescribed to take home.	The inflammation may take weeks to settle fully.
An outpatient appointment should be arranged.	Checking that control has been obtained and that long-term maintenance treatment can be chosen.
A written self-management plan should be devised, given to the patient and recorded in the notes.	An indication that the patient has been informed about asthma and asked to contribute to their own asthma management.

Methods

The study was a questionnaire-based retrospective audit of case records of patients admitted with acute severe asthma in the 2 months (August–September 1990) immediately before the publication of the Guidelines, which was then repeated in the same 2 months of 1991. Thirty-six hospitals (12 teaching and 24 district general hospitals across England, Scotland and Wales) took part in 1990, and 34 of those hospitals repeated the study in 1991. Data were collected at least 2 months after the admission. Two hospitals did not repeat the audit in 1991; their 25 patients were similar in respect of demography, previous asthma history, treatment and therapy.

CASE DEFINITION

All adult patients admitted as emergencies with acute severe asthma between 1 August and 30 September 1990 were included in this study. The diagnosis of asthma was that made by the local physician; patients admitted electively for stabilization or investigation were not included. The method of identification of cases was determined by the local co-ordinators, who were responsible for ensuring that all patients admitted with acute severe asthma to their hospital were included in the survey, and for obtaining the agreement of their physician colleagues. The methods of identifying cases varied between centres and included specific asthma registers, hospital activity analyses from hospital computers, and admission registers in the accident and emergency departments.

QUESTIONNAIRE

A questionnaire derived from the criteria set out in the Guidelines was designed to assess those features of care considered to be the most crucial aspects of management of acute asthma. These included acute assessment of the patient, initial treatment, monitoring progress in hospital, the discharge process and arrangements for follow-up within the subsequent 2 months. From the first audit, eight variables were selected as 'minimum data set' (8) on the basis that they were recordable, reflected different aspects of the asthma management process and had demonstrated important deficiencies in the first audit (7) (Table 1). Each of these variables can be audited either as a simple record of whether a particular action was or was not performed, or as the actual values to allow more detailed assessment of performance (the full questionnaire is available on request from the authors).

Completed questionnaires were collected centrally and entered into a computer using Microstat software (Ecosoft, Indiana). Where necessary, data were verified with the individual unit to check accuracy. Statistical comparisons were done using the χ^2-test to compare incidences of events, and by non-parametric analysis of variance (Kruskal–Wallis). The exclusion

Table 2 Demography and previous therapy of patients in 1990 and 1991, subdivided according to the type of physician in charge of their care

	General physicians		Respiratory physicians		Total	
	1990 (n=340)	1991 (n=409)	1990 (n=426)	1991 (n=491)	1990 (n=766)	1991 (n=900)
Age	41 (16–94)	38 (14–91)	41 (16–91)	37 (16–81)	41 (16–94)	38 (14–91) [P<0·01]
No. female (%)	212/237 (65)	245/404 (61)	253/415 (61)	284/488 (58)	465/742 (63)	529/892 (59)
Current smokers	108/295 (37)	105/352 (30)	105/412 (25)	144/464 (31)	213/707 (30)	249/816 (31)
On oral steroids	50/340 (15)	66/409 (16)	122/426 (29)*	123/491 (25)†	172/766 (22)	189/900 (21)
On inhaled steroids	191/340 (56)	225/409 (55)	297/426 (70)‡	297/491 (61)	488/766 (64)	522/900 (58)
Previous admissions	166/322 (52)	197/409 (48)	282/412 (68)§	295/487 (61)‖	448/734 (61)	492/896 (55)
Days in hospital	4 (1–34)	5 (1–23)	5 (1–41)	5 (1–73)	5 (1–41)	5 (1–73)
On nebulized β-agonists	26/340 (8)	45/409 (11)	88/426 (21)¶	98/491 (20)**	114/766 (15)	143/900 (16)
Arrival PEF (median)	160 (u/r–470)	140 (u/r–480)	170 (u/r–450)	150 (u/r–600)	170 (u/r–470)	150 (u/r–600)
Best PEF pre-discharge	355 (100–650)	350 (80–655)	370 (110–690)	360 (80–680)	365 (100–690)	360 (80–680)

The following differences between patients under respiratory and general physicians were noted: *χ^2=21; †χ^2=10·7; ‡χ^2=14·9; §x^2=21·7; ‖χ^2=13·8; ¶χ^2=25·3; **χ^2=13·4; all P<0·01. u/r, unrecordable.
Except for age, there are no significant differences between 1990 and 1991 for patients under general or specialist physicians.

of the two hospitals who did not participate in 1991 does not affect any of the conclusions. Since eight variables are being compared, the Bonferroni correction sets a P value of 0·006 as the 5% significance level.

Results

The demography, previous therapy and previous asthma history are outlined in Table 2. There were 21% more recorded admissions in 1991 (900 *vs.* 741 in the same 34 hospitals) and the median age was significantly lower. In 1991, fewer patients were on inhaled steroids (58% *vs.* 64%, χ^2=5·4, P<0·05) and less had had previous admissions for asthma (55% *vs.* 61%, χ^2=6·1, P<0·05). The two cohorts were otherwise very similar and had asthma of comparable severity on admission, with 20% (135/676) unable to speak in complete sentences in 1990 *vs.* 19% (146/784) in 1991, and median PEF of 170 l min^{-1} in 1990 *vs.* 150 l min^{-1} in 1991. Patients admitted to the care of respiratory physicians in both years were significantly more likely to be on regular oral steroids, and to have had previous admissions for asthma (Table 2).

Table 3 compares whether the eight selected variables were or were not recorded in each year, divided by physician type. For both years, the performance of respiratory physicians was significantly better than that of the general physicians for each of the items. Respiratory physicians were more likely to provide patients with a written self-management plan in 1991 than in 1990 (χ^2=7·9, P<0·02), although, in most cases, there was still no plan recorded. Apart from this, there was no change in the performance of respiratory physicians.

The general physicians' performance was not significantly improved for any of the eight variables individually. However, for seven variables, there was a non-significant trend towards improvement and, using a paired Wilcoxon test to compare the year-on-year change for all eight variables, suggests a small but significant (P<0·01) improvement in the care provided by the general physicians.

In order to examine changes within individual hospitals, an 'index of hospital performance' (8) has been created. For each of the variables in Table 3, the percentage of cases in which that variable was performed and recorded has been calculated for each hospital. The mean (unweighted) value of these

Table 3 Comparison of 1990 and 1991 audit data using the eight selected variables, subdivided by type of physician caring for the patient

	General physicians		Respiratory physicians		Total	
	1990	1991	1990	1991	1990	1991
PEF recorded on arrival	282/340 (83)	342/409 (84)	379/426 (89)	427/491 (87)	661/766 (86)	769/900 (85)
PCO_2 done on arrival	197/340 (58)	237/409 (58)	337/426 (79)*	368/491 (75)†	534/766 (70)	605/900 (67)
Oral i.v. steroids in first 24 h	273/340 (80)	335/409 (82)	375/426 (88)‡	437/491 (89)§	648/766 (85)	772/900 (86)
PEF variability measured	244/340 (72)	302/405 (75)	353/423 (83)‖	407/487 (84)¶	597/759 (75)	709/892 (79)
Inhaled steroids on discharge	246/334 (74)	319/405 (78)	367/425 (86)**	405/487 (83)	613/759 (81)	725/892 (81)
Oral steroids on discharge	232/334 (69)	299/405 (74)	365/425 (91)††	405/487 (83)‡‡	597/759 (79)	704/892 (79)
Outpatients appointment planned	189/335 (56)	250/405 (62)	372/408 (88)§§	416/487 (85)‖‖	561/743 (76)	666/892 (75)
Self-management plan given	16/282 (6)	31/328 (9)	41/347 (12)	64/319 (20)¶¶,***	57/629 (9)	95/647 (15)†††

For each of the following, values for respiratory physicians are higher than for general physicians: *$\chi^2=40{\cdot}1$; †$\chi^2=29{\cdot}3$; ‡$\chi^2=8{\cdot}7$; §$\chi^2=9{\cdot}2$; ‖$\chi^2=13{\cdot}1$; ¶$\chi^2=10{\cdot}9$; **$\chi^2=19{\cdot}4$; ††$\chi^2=30{\cdot}0$; ‡‡$\chi^2=12{\cdot}4$; §§$\chi^2=120{\cdot}0$; ‖‖$\chi^2=64$; ¶¶$\chi^2=14{\cdot}5$. Better performance in 1991 *vs.* 1990: ***$\chi^2=7{\cdot}9$; †††$\chi^2=8{\cdot}7$.
A χ^2 value of above 7·4 indicates significance at the 5% level.
A χ^2 value of above 10·3 indicates significance at the 1% level.

percentages within each hospital has then been calculated as a score. Thus, for example, a value of 100 would indicate that each item was always recorded and a value of zero would indicate that nothing had been recorded. Figure 1 compares individual hospital performances in 1990 and 1991. There is a significant linear correlation ($P<0{\cdot}01$) for hospital performance in these two years. Reasons for changes within each hospital were not recorded but may not necessarily have reflected better performance by the physicians. Thus, in one hospital, the improvement from 71 to 84 on the performance scale was entirely due to a change in the admission policy of the accident and emergency department (AED) with 75% of patients being admitted under the respiratory physicians in 1991 compared with 47% in 1990.

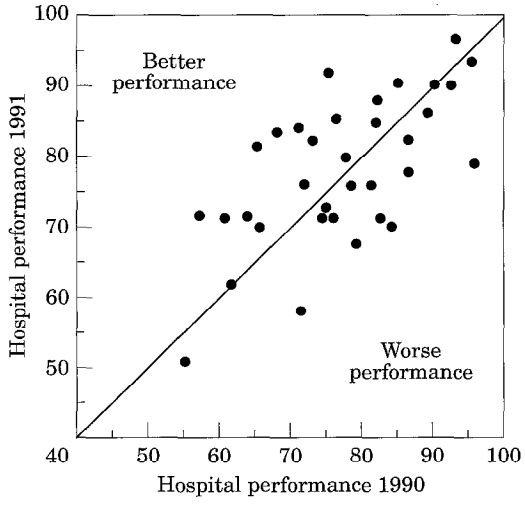

Fig. 1 Mean scores for the eight variables for each hospital comparing 1990 and 1991 with the line of identity. Performance between years is significantly correlated at the 1% level.

OUTCOMES OF THE ADMISSION

Deaths in hospital (seven in 1990 and eight in 1991) and early re-admission within 2 months of discharge were similar in 1990 and 1991 [102/759 (13%) in 1990 and 113/892 (13%) in 1991]. As noted in the 1990 survey (7), early re-admission was more likely in patients with a history of admissions prior to the index admission [93/113 (81%) *vs.* 395/779 (51%), $\chi^2=39{\cdot}3$, $P<0{\cdot}01$], patients on regular oral steroids prior to admission [47/113 (42%) *vs.* 137/779 (18%), $\chi^2=33{\cdot}3$, $P<0{\cdot}01$] and in patients discharged on oral nebulized therapy [46/113 (41%) *vs.* 97/779 (12%), $\chi^2=56{\cdot}5$, $P<0{\cdot}01$]. Follow-up in hospital outpatients was unchanged between the surveys and remains much more likely to be planned by respiratory physicians (Table 3). There continues to be a high non-attendance rate at clinics [21% (109/731) in 1990

and 20% (174/888) in 1991]. As in 1990 (7), clinic non-attendance in 1991 was more frequent in the under-45-year age group [76/285 (27%)].

Discussion

The 1990 audit revealed important areas in which the processes of care could be improved when compared with the criteria or standards published in the Guidelines (5). Deficiencies were more common when patients were under the care of general physicians. The changes between the two studies were very small but there was an encouraging, and just significant, improvement by the general physicians, although the marked contrast between specialist and generalist remained. Generally, respiratory physicians achieved high performance rates of 80–90% on seven of the eight variables in the 'minimum data set' in both years, and there was significant improvement in the eighth variable in 1991. There was no significant difference between the year-on-year performance of individual hospitals. The scatter either side of the line of identity in Fig. 1 might indicate improved or worsening performance in individual hospitals, but since there was no overall improvement, this is more likely to be an indication of the reproducibility of the audit measurement. Perhaps the most important observation is that it is possible for some hospitals to perform consistently well, which makes the performance of other hospitals less excusable.

It is possible that the diagnosis was wrong in a few patients. However, only 8% of patients did not improve their peak expiratory flow (PEF) by more than 50% during the admission (7) and, in all cases, the physician had made the diagnosis of asthma and thus could have been expected to treat the patient as suggested by the Asthma Guidelines.

In the year between the two audits, the Guidelines were published in the *British Medical Journal*, asthma was highlighted in the Health of the Nation green paper (although not subsequently included in the white paper) and many general practices established asthma clinics as part of funded health promotion activities. In the July before the audit was repeated, the data from the 1990 audit were presented at symposia at the Royal College of Physicians and at the British Thoracic Society, and many of the participating hospitals used their own hospital's data at internal audit meetings. Considering this activity, it is disappointing that so little changed between the two audits. Since each of these hospitals had already been made aware of asthma and of the deficiencies in care by participating in the first audit, it is unlikely that hospitals outside this study would have performed any better. There are a number of possible explanations for this lack of change:

(1) The interval of 1 yr between publication of the Guidelines and re-audit may have been too short to measure changes that might yet occur over a longer period. This might be studied by a further audit say 5 yr after the first.
(2) It may be that many doctors looking after asthma patients either did not read the papers in the *BMJ*, or found that the 1990 Guidelines were too long for use in busy day-to-day hospital practice. The criticism of length was one of the reasons for revising the Guidelines in 1993, and included a series of simple charts, each on a single sheet, applicable to and specific for general practice, the accident and emergency department and the hospital ward. Furthermore, a copy of the 1993 Guidelines was sent to all general practitioners in the U.K.
(3) Perhaps some physicians noted the Guidelines paper, but did not consider it their responsibility to ensure that the contents were applied either to their hospital in general or to their own particular clinical practice.
(4) Lastly, it is probable that simply 'publishing' guidelines is not enough. There are at least 10 studies repeatedly demonstrating potentially avoidable factors in asthma deaths during which asthma deaths increased (4). Guidelines need to be accepted locally as relevant and specific initiatives adopted to implement change. For asthma, one study has demonstrated that 'local ownership' of a guidelines policy together with direct feedback of repeated audit can produce changed practice (9), and the improvements are maintained as long as there is continued enthusiasm and involvement (Harrison, pers. comm.). Although there was much general asthma activity between 1990 and 1991, there was no co-ordinated effort to achieve implementation of the Guidelines locally in each hospital in the U.K., there were no incentives for anyone to take the initiative, and there was no routine monitoring, either official or unofficial, of the standards of care being provided. A recent review of 59 evaluations of clinical guidelines (10), selected because they met strict criteria of scientific rigour, showed that the process of care improved significantly in 55 evaluations. In the 11 evaluations where outcome was

evaluated, nine showed significant improvements. However, the size of the improvements in both process and outcome varied considerably.

These two audits are certainly large enough to remove the biases that can affect and distort small studies from individual hospitals. Over 150 data items were collected from each patient and the authors would not propose to repeat an audit on this scale in the future. The initial enthusiasm surrounding Guidelines publication, and around audit activity in general, was substantial in 1990, and was reflected in the substantial personal contribution of the authors' physician colleagues, much of it outside of normal working hours. This enthusiasm and the unusual availability of funding that allowed the proposed audit to proceed immediately is unlikely to be repeated. Two hospitals were unable to repeat the audit and the authors have experienced some difficulty recruiting hospitals for a separate exercise of outpatient asthma management. It would seem that audit fatigue has set in. This is understandable, considering the increased demands on consultant time from containing medical education, management, training junior colleagues and providing the clinical service no longer performed by the trainees. Fortunately, now that these detailed surveys have been performed, it is possible to perform useful audits with a much smaller data set (8). The data from these audits will be retained as a reference for comparison with future audits, and will be available to any hospital wishing to perform audits utilizing the new short audit proforma in the future (the revised proforma is available from the Asthma Audit Office, Aintree Chest Centre, Fazakerley Hospital, Lower Lane, Liverpool L9 7AL, U.K., free of charge). These audits show that whilst it may be very difficult and very time- and energy-consuming to produce and publish agreed guidelines on the management of a medical condition, it is even more difficult to implement them. Those preparing guidelines not only need to audit their efficiency but must, from the outset, consider ways and means of ensuring active implementation (10). The current purchasing and providing system of the National Health Service provides a mechanism which could well be harnessed to this process.

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Appendix 1

A SUMMARY OF RECOMMENDATIONS FROM THE ASTHMA GUIDELINES THAT SHOULD ALWAYS BE PERFORMED ON PATIENTS ADMITTED WITH ACUTE SEVERE ASTHMA THAT HAVE BEEN ASSESSED IN THIS PAPER

Clinical assessments

Assessment of level of consciousness

Ability to speak in complete sentences

Recording of
- Heart rate
- Respiratory rate
- Pulsus paradoxus

Measurement of
- Peak expiratory flow
- Arterial blood gases

Treatment on arrival should include:

High-dose nebulized β_2-agonist – if not improving at 15–30 min repeat dose or add nebulized ipratropium bromide

High-dose systemic steroids

If obviously life-threatening features present, add i.v. aminophylline

Management in hospital

Patients should not be discharged until symptoms have settled and lung function has stabilized, i.e. PEF>75% predicted and diurnal variability <25 Discharge from hospital

All patients should be discharged on oral steroids for 1–3 weeks and be on inhaled anti-inflammatory treatment (steroids)

All patients should have a written self-management plan

All patients should have outpatient follow-up